The natural occurrence of native iron in basalt from Bühl near Weimar, Kassel, Germany: a new study based on historical samples

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The occurrence of metallic iron within the Miocene basaltic intrusion in Bühl is historically known and was investigated in detail around 1920. However, most of the publications are only in German, remaining unavailable nowadays for the broad scientific community. Bühl presents some features that are different from those shown by other well-known occurrences of native iron in basalt, namely Ovifak-Disko Island (Greenland) and in the Putorana plateau (Russia). These notable characteristics include: the lack of Ni, the occurrence of iron in nodules, each with different properties and not equally spread across the basalt, the presence of magnetite in the basalt (indicating partial oxidation of Fe), the occurrence of pyrrhotite and troilite in association with the metallic iron, and, finally, chemical and isotopic differences. The formation of native iron in the case of Bühl has been explained by local reduction of the basalt, induced by interaction with coal seams and local organic-rich sediments. The influence of reducing CO volcanic gases was excluded in the historical literature. The iron occurrence in Bühl has been completely exploited and, nowadays, the only accessible samples are in museums and private collections. The Natural History Museum Vienna owns a series of historical hand specimens and petrographic thin sections from this locality. Here, the first results of a study of this historical material, using newly prepared polished sections, is presented. Up-to-date analytical methods for petrography and geochemistry, and a modern petrologic approach will be used to investigate the close relationship between the metal and the basaltic fractions. A comparison with the results of the historical studies will be also provided. This work aims to improve our understanding of the formation process of native iron in the basalt from Bühl, and to provide additional constraints to the current formation model proposed for any natural occurrences of metallic iron in basaltic rocks, based on the reduction of basalt by crosscutting carbon or organic-rich layers.